

ACUTE HAND INJURY PROTOCOLS

I. FRACTURES OF THE HAND AND DIGITS

A. Background

Digital and hand fractures are common in workers who use their hands due to the exposed nature of the upper extremity in most functions at work. Most fractures are due to local trauma caused by an applied force. The energy of applied force determines the severity of the local fractures. Digital fractures are much more common than hand fractures alone.

B. Diagnostic Criteria

Patients present complaining of pain and discomfort in the injured digit, thumb or hand. It is important to obtain a detailed history of the patients' age, occupation, and pursuits, hand dominance and previous hand impairments or injuries. The date of injury should be documented, and the time between injury and care should be determined. The place of injury should be detailed, and the conditions in this environment should be questioned to determine whether the wound or injury is clean or dirty. The exact mechanism of the injury should be evaluated. A past medical history and review of systems should be obtained as part of the complete evaluation.

Each examination should determine if there is abnormal swelling or tenderness over a particular area of a digit. Range of motion of the digit should be evaluated. The vascular state of the digit is checked by observation for signs of ischemia, congestion, or cyanosis. A neurologic examination should be carried out using two-point discrimination. The soft tissue envelope surrounding each fracture should be checked to make sure whether the fracture is open or closed.

C. Appropriate Diagnostic Tests and Examinations

1. Appropriate x-rays must be ordered including true laterals of the digital or metacarpal fractures.

2. On infrequent occasion, noninvasive vascular studies may be deemed appropriate when there is a suspicion of circulatory compromise.

D. Outpatient Treatment

1. Treatment would be splinting, and should heal in four or six weeks provided conservative measures have been instituted.

a. Indications:

1. Pain
2. Limited Motion

b. Treatment Options:

1. Closed reduction as required with/without anesthesia
 - a. Digital finger splints
 - b. Intrinsic plus splints
 - c. Buddy taping
 - d. Intrinsic plus casting

c. Rehabilitation:

1. After initial healing, active and passive range of motion exercises of the digits, thumb, hand and wrist
2. Strengthening exercises of grip
3. Activity of daily living modification and limitation of job tasks

d. Duration of Care:

6 - 10 weeks

e. Return to Work Status:

1. No use of injured hand, 2 - 3 weeks in most cases
2. Use of injured hand, 6 - 8 weeks

2. Closed reduction, internal fixation / open reduction internal fixation / surgery.

a. Indications:

1. Failure to respond to conservative management
2. Failure to correct digital deformity of displacement
3. Intra-articular joint fracture which cannot be treated closed
4. Open fractures requiring irrigation and debridement

b. Treatment Options:

1. Closed reduction internal fixation
2. Open reduction internal fixation

c. Rehabilitation:

1. After initial healing, active and passive range of motion exercises of the digits, thumb, hand and wrist
2. Strengthening exercises of grip
3. Activity of daily living modification and limitation of job tasks
4. Range of motion exercises after the fracture has healed
5. Wrist splint

d. Duration of Care:

For operative treatment, 3 - 4 months following surgery

e. Return to Work Status:

1. No use of injured hand, 3 - 5 weeks
2. For use of injured hand, 6 - 10 weeks

II. DISLOCATIONS OF THE DIGITS AND HANDS

A. Background:

Dislocations may occur during work. These dislocations require severe tearing of some of the structures surrounding the joints of the digits and the joints of the hand and wrist. An appropriate assessment is very important, as in all of these injuries the joints that are dislocated must be reduced in order to allow adequate post injury function. After repair of these injuries, a period of immobilization that is kept too long may lead to unusual stiffness in the digits. At the time of the initial injury, patients may sustain injury to the cartilage of the joint resulting in traumatic arthritis occurring at a later stage.

B. Diagnostic Criteria:

Most patients complain of a traumatic event requiring a hyperextension force at the level of the digits or in the case of metacarpal dislocations, a direct blow to the knuckles of the hand. The patients present with severe swelling and pain and a deformed digit or hand.

Physical findings include swelling, pain, and limited digital motion. Most deformities are visible on initial examination.

C. Appropriate Diagnostic Tests and Examinations:

1. True lateral radiographs of the digits including AP, lateral, and oblique.
2. True lateral radiographs of the hand including metacarpals which include AP, lateral, and oblique x-rays.

D. Outpatient Treatment:

1. Nonoperative Treatment

Treatment time limited from 6 - 10 weeks

a. Treatment Options:

1. Closed reduction of digital joints under local anesthesia.
2. Immobilization after reduction using digital splints, intrinsic-plus splints of the hand and wrist and/or cast.

b. Rehabilitation:

1. Active and passive range of motion exercises instituted two to six weeks after injury
2. Grip strength exercises
3. Modification of activities of daily living and/or job tasks

c. Return to Work Status:

1. No use of injured hand, 1 - 2 weeks
2. Use of injured hand, 2 - 3 weeks

2. Surgery

a. Indications:

1. Inability to reduce a dislocation under closed conservative treatment
2. Open dislocations of the digits
3. Joint dislocations that are irreducible with injuries to the extensor or flexor tendons

b. Treatment Options:

1. Closed reduction, internal fixation reduction
2. Open reduction
3. Open reduction internal fixation with ligament or tendon repair

c. Rehabilitation:

Rehabilitation in this group takes longer but consists of the same rehabilitation options listed above.

d. Estimated Duration of Care:

1. Operative treatment: 10 - 12 weeks after surgery

e. Return to Work Status:

1. No use of injured hand, 3 - 4 weeks
2. Use of injured hand, 8 - 10 weeks

III. FRACTURES AND DISLOCATIONS OF THE WRIST

A. Background

Fractures and dislocations of the wrist are among the most frequently missed diagnoses of emergent musculoskeletal problems. Complex dislocations of the wrist have been reported to be missed in some emergency room series, as many as 60% of patients presenting with these injuries. Careful evaluation by physical examination, history and radiographic analysis will generally recognize all carpal injuries.

B. Diagnostic Criteria:

1. Pertinent History and Physical Findings:

Patients with fractures and dislocations of the wrist sustain injury by having a direct blow to the wrist or falling, sustaining a hyperextension or injury to the hand and wrist. The intricate anatomy of the carpal bones and the multiple overlapping shadows on a radiograph make these injuries more difficult to diagnose. Most injuries are missed at the initial examination. A treating physician must be aware of tenderness over the anatomical snuff box of the wrist and scaphoid fractures and significant swelling and restriction of motion which occurs in serious ligament disruptions. Wrist sprain diagnosis should not be made until a fractured scaphoid and serious ligament injury is ruled out.

The patients present with tenderness and swelling at different localized portions of the wrist. The swelling and discomfort is localized to the area where the injury has occurred. Most patients have difficulty with gripping and with bending the wrist in extension and flexion. Patients may occasionally have symptoms of numbness and tingling in the median or ulnar nerve distribution depending on the level of injury and the site of injury.

Physical examination will find resisted wrist extension or flexion, swelling in different parts of the wrist and point tenderness over the anatomical area injured.

2. Appropriate Diagnostic Tests and Examination

- a. Radiographs of the wrist
- b. Tomograms and CT scans of the wrist for suspected nonunion
- c. Arthrograms and fluoroscopic examinations of the wrist when physical examination shows evidence of wrist instability

3. Treatment

- a. Outpatient treatment/nonoperative treatment
Treatment time is based on the specific injury. Some fractures, such as triquetral fractures, may heal in four to six weeks. Scaphoid injuries may take from three to six months to heal treated conservatively. The treatment options may take from three to six months to heal treated conservatively.

1. Treatment Options

- a. Neutral position wrist splint
- b. Thumb spica short arm cast, thumb spica long arm cast

2. Rehabilitation:

a. Digit hand and wrist exercises, including active and passive range of motion and grip strengthening

b. Modification of activities of daily living and/or job tasks when told the injury is completely healed.

b. Surgery

1. Indications

Failure to heal with nonoperative management

2. Treatment Options

a. Open reduction, internal fixation of fracture

b. Open reduction and operative repair of ligament injuries

c. Intercarpal fusions

d. Radiocarpal fusions

e. Wrist arthroscopy

c. Rehabilitation

1. Digital hand, wrist active and passive range of motion exercises.

2. Grip strengthening exercises, wrist splinting in position of extension

d. Estimated Duration of Care

1. Nonoperative treatment
In most cases, 6 weeks to 6 months

2. Operative treatment
3 to 6 months following surgery

e. Return to Work Status:

1. No use of injured hand, 3 - 4 weeks
2. Use of injured hand, non-operative,
6 - 12 weeks
3. Use of injured hand, operative, 8 - 14
weeks

IV. TENDON INJURIES

A. Background

The flexor and extensor tendons of the digits lie superficial underneath the skin and, therefore, are commonly injured structures. They are a significant problem for patients, physicians, rehabilitation specialists and hand specialists. The primary care of each patient with tendon injuries will determine their final outcome. Diagnosis is difficult despite careful examination due to the complexity of the extensor and flexor tendon systems in the upper extremity. Every lacerated hand is suspect to this type of injury. Even a small wound in a finger can be associated with a complete laceration of two tendons. Topographical anticipation is very important in evaluating these injuries.

B. Pertinent Historical and Physical Findings

A complete rupture of an extensor flexor tendon may occur without a wound of any kind. Spontaneous ruptures can occur in patients with medical conditions while at work. Most open tendon injuries are secondary to sharp objects which cause wounds to skin and soft tissues. The position of the hand at the time of injury is important to determine where the tendon may be injured. Most patients present stating they cannot fully bend or extend their finger or hand and have altered function. Most present with pain and sometimes present with numbness in the digit.

Physical examination of all tendon injuries includes subtle evaluation of the normal stance of the digits in both flexion and extension. Active motion tests when

performed will show a lack of motion in affected digits. Partial lacerations can be noted in patients who have pain.

C. Appropriate Diagnostic Tests and Examination

1. Radiographs of digit
2. Sensibility tests of digits after injury

D. Treatment

Outpatient treatment

Nonoperative treatment. In closed extensor tendon injuries, patients can be treated with conservative measures.

1. Treatment Options

- a. Neutral position intrinsic plus splints
- b. Digital splints
- c. Buddy taping

2. Rehabilitation

- a. Active and passive range of motion of digits, hand and wrist
- b. Grip strengthening exercises

E. Surgery

1. Indications

- a. All open tendon injuries with open wounds with limited motion, pain with motion or expectant tendon injury
- b. Closed flexor tendon injuries
- c. Failure to respond to nonoperative treatment and rehabilitation after appropriate time to heal, active and passive range of motion exercises of the digits and hand

2. Estimated Duration of Care

Nonoperative treatment

8 to 12 weeks after injury

Operative treatment

3 to 6 months after injury

3. Return to Work Status:

a. Non-operative treatment, 6 weeks

b. Operative treatment, no use of injured hand,
3 - 4 weeks

c. Operative treatment, use of injured hand, 8 -
10 weeks

V. DIGITAL NERVE INJURIES

(with addendum regarding peripheral nerve injuries in
general)

A. Background

Most of the significant injuries to the digital
nerves result in loss of sensibility distal to the level of
injury and are usually the result of lacerations frequently
involving the flexor tendons. Significant contusions or
crush may disrupt the ability of the nerve to function
without physically dividing it.

B. Diagnostic Criteria

1. Pertinent History and Physical Examination

a. History of trauma

Usually with a laceration over the volar
surface of the digit (palm for common digital nerves)

b. Absent sensibility (feeling)

In the distribution of the nerve in question

2. Appropriate Diagnostic Tests

a. Gross Touch - diagnostic if deficit is in appropriate anatomic distribution with laceration overlying the expected course of the nerve

b. Quantitative

1. two-point discrimination (moving and static)

2. monofilament testing

3. vibration

C. Treatment

1. With laceration and probable division of the nerve - operative exploration and repair with magnification. Repair end-to-end if healthy nerve, divided ends can be approximated without significant tension. Otherwise repair with interposition nerve graft.

a. Immediate

If the patient is a suitable operative candidate

b. Urgent

Skin wound may be closed and repair delayed for up to 7 days and subsequently repaired primarily.

c. Delayed

Over 7 days, if the patient is unstable or graft is known to be needed. After 7 days, neuroma at the divided nerve ends will need to be resected and more nerve length required for closure without tension than if repaired sooner.

2. With laceration - and diagnosis of nerve division is equivocal

a. Explore

1. If the patient is at surgery for other injuries

2. If the wound does not need to be enlarged

b. Observe

With closure of the wound and reassessment in
1 - 3 days

3. Without laceration

a. Observe for progression of return of function
(Tinel's sign)

b. Explore if progression of Tinel's sign is not
seen

D. Rehabilitation

1. Splint for 3 weeks to maintain minimal tension on
the nerve repair with elevation to minimize swelling

2. Range of motion begun on the splinted joints
after 3 weeks avoiding stretching of or trauma to the nerve
repair for an additional 3 weeks

3. Estimated Duration of Care

a. Return to work not requiring stretch of or
trauma to the nerve repair area or sensibility in the nerve
distribution during the third through the fifth week after
repair

Return to work with injured hand, excluding
use of the injured digit, at 5 weeks.

b. Return to work requiring sensibility in the
nerve distribution

1. Gross sensibility - 1 mm. per day or 1
in. per month. Nerve regeneration beyond the level of
injury as indicated by advancing Tinel's sign and return of
sensibility

2. Maximum return of sensibility as
approximately twice the time required for gross sensibility
(return of nerve function after significant injury is never
100%, but may range from none to the case where function is
less than 100% but abnormality may not be detectable.)

c. Maximum medical improvement - 3 to 6 months
depending upon IV.C.2.b above and wound scar maturation.

If function is unsatisfactory after IV.C.2.b, resection of neuroma and nerve grafting may be indicated.

N.B. Peripheral Nerve Injuries

The preceding generally applies for all peripheral nerve injuries. The more proximal the injury the longer to return to function and the less likely that the functional return will be complete.

Mixed and motor nerve injuries have self-evident other diagnostic criteria and functional impairment implications related to the loss of respective motor function. If motor return does not occur or is unlikely, then tendon transfers may be indicated.

VI. FINGER TIP INJURIES

A. Background

Finger tip injuries are among the most common work-related injuries in the manufacturing and construction sectors.

B. Diagnostic Criteria

1. Definition

For the purpose of this protocol, finger tip injuries include those in which there is some full-thickness soft tissue loss and/or compound fracture of the distal phalanx of an upper extremity digit and/or nail bed injury requiring repair. Significant injuries which continue proximal to the DIP joints are considered separately as more severe.

2. Diagnosis

Physical (and x-ray) examination

C. Treatment

1. Out-patient emergency room facility

Debridement and repair of lacerations
Reduction of fractures
Skin grafts (full or partial thickness)
Local flaps
Amputations

2. Out-patient operating room (occasionally requiring overnight hospitalization)

Fixation of complex or intra-articular fractures
Pedical flaps

3. In-patient operating room

Sensory neurovascular island flap (rare)

D. Rehabilitation

1. Elevation and protection of fractures

2. Gradual mobilization and desensitization

3. Estimated duration of care -

a. 3 - 6 weeks to return to light non-forceful, non-dextrous or non-discriminating use of the injured digits
b. 6 - 12 weeks to return to forceful use of injured digits (grafts and flaps will not have normal sensibility resulting in some permanent impairment)

4. Return to work status -

No use of injured hand - 2 - 3 weeks

5. Maximum Medical Improvement in 3 - 4 months

(older patients take longer to recover mobility)

VII. ULNAR COLLATERAL LIGAMENT INJURY OF THE THUMB (SPRAIN/TEAR)

A. Background

Injuries to the ulnar collateral ligament of the thumb are sustained in a variety of ways. These include a fall from a height that results in a radial deviation force

being applied to the metacarpophalangeal joint such that the ligament is placed under tension. The ligament may tear partially or completely, or be avulsed from its bony attachment with or without an associated fracture. The injury is commonly seen as a result of falls during skiing and during contact sports. Pain, swelling, and weakness are frequent presenting complaints.

B. Diagnostic Criteria

1. Pertinent History and Physical Findings

There is a history of a blow or a fall involving the thumb. There is pain with motion of the thumb and swelling about the ulnar collateral ligament of the thumb. Palpation along the ulnar aspect of the metacarpal phalangeal joint may reveal a lump where the avulsed ligament is rolled up on itself. Instability may be present on ulnar stress.

2. Appropriate Diagnostic Tests and Examinations

- a. X-rays of the injured thumb followed by (b)
- b. Stress examination with or without x-ray documentation
- c. Comparative examination of the opposite thumb

3. Inappropriate Diagnostic Tests and Examinations

- a. Arthroscopy of MP joint
- b. CT scan
- c. MRI
- d. Radionuclide scan

4. Exceptions to Criteria

None

5. Evolving Diagnostic Tests and Examinations

- a. Arthrography, as indicated
- b. CT scan
- c. MRI
- d. Radionuclide scan

C. Treatment

1. Outpatient Treatment

a. Nonoperative treatment

1. Indications

a. When there has been an incomplete injury to the ligament such that it is not completely disrupted either within its substance or from its attachments

b. When there is a nondisplaced fracture at the attachment of the ulnar collateral ligament

2. Treatment options

a. Immobilization for approximately 4 - 6 weeks

b. Elevation and range of motion of all uninvolved joints

3. Home Health Care

None

4. Rehabilitation

Active ROM after cast or splint removal

b. Ambulatory Surgery

1. Indications

a. Any displaced or avulsed fracture with ligament attachment

b. Complete ligament disruption

c. Stenner's lesion (displacement of the ulnar collateral ligament superficial to the adductor tendon)

2. Treatment Options

a. Exploration and ligament reapproximation or fracture reduction and/or fixation with attached ligament followed by immobilization for approximately 6 - 8 weeks

b. Primary or secondary reconstruction

c. Postoperative elevation and range of motion of all uninvolved joints

3. Home Health Care

None

4. Rehabilitation

Active ROM after cast or splint removal

c. Non-operative treatment

1. No use of injured hand, 3 weeks

2. Use of injured hand, 8 - 10 weeks

d. Operative treatment

1. No use of injured hand, 4 weeks

2. Use of injured hand, 10 - 12 weeks

VIII. DIGITAL STENOSING TENOSYNOVITIS (TRIGGER FINGER)

A. Background

Caused by irritation and inflammation of the flexor tenosynovium at the A-1 pulley of the digital flexor tendon sheath. This can be due to trauma in a single event or repetitive "micro-trauma", or inflammatory process. This is often seen with other manifestations of tendinitis or tenosynovitis such as carpal tunnel syndrome and DeQuervain's tendinitis.

B. Diagnostic Criteria

1. Pertinent History of Physical Findings

Most commonly repetitive grip, forceful hand tool use or use of vibratory tools will lead to gradual onset of pain and limitation of full flexion with clicking or "triggering" of the digits. Alternatively there may be a single episode of pain with forceful grip or hyperextension of the involved digit.

Physical exam will demonstrate specific pain over the flexor sheath of the digit with most tenderness over the A-1 pulley (distal palmar crease), crepitance in this area with active motion, passive motion arc greater than active motion arc and then audible and palpable click as

the digit triggers when placed through a range of flexion and extension.

Associated swelling of the fingers (such that rings do not fit), worse stiffness in the morning and less during the day are also common.

2. Appropriate Diagnostic Tests and Exams

a. X-ray of the hand to rule out associated arthritis or bony lesions.

b. Clinically suspicious for connective tissue disease, studies to rule out systemic disease could be considered

3. Inappropriate Tests

a. MRI

b. Ultrasound

c. CT Scan

4. Exceptions to Above Criteria

Investigations with MRI and/or ultrasound if suspicious lesion other than classic stenosing tenosynovitis is considered; i.e., suspicion of tumor.

C. Treatment

1. Non-operative Treatment

a. Indications: pain, triggering, functional disability

b. Treatment Options:

1. Non-steroidal anti-inflammatory medications

2. Intermittent splinting

3. Tendon sheath steroid injection (up to three times)

4. Activity alterations

2. Operative Treatment: Out-patient Surgery

a. Indications

No response to non-operative treatment over a 4 - 10 week period depending on symptom complex

b. Treatment Options

1. Operative release of the A-1 pulley, partial excision and partial release of a 2 pulley proximal margin under local, regional, or general anesthesia

2. Limited tenosynovectomy of flexor tendons

c. Rehabilitation

1. Progressive active range of motion and strengthening

2. P.T. may be needed for scar tenderness or post surgical stiffness

3. Occasionally with long term trigger fingers a period of postoperative splinting to regain full extension may be needed

3. Estimated Duration of Care

1. Nonoperative treatment, 4 - 10 weeks depending on symptom complex

2. Operative treatment, 3 - 6 weeks recovery from surgery with occasional post operative splinting

4. Anticipated Outcome

1. Complete resolution of the symptoms

2. Full unrestricted use of the hand

5. Return to Work Status

1. Non-operative, 2 - 5 weeks

2. Operative

a. No use of injured finger, 2 weeks

b. Use of injured finger, 4 - 6 weeks

PROTOCOL HISTORY:

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